An introduction to some liverworts on Black Mountain

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Liverworts are tiny plants usually found growing on the soil surface, often occurring with mosses. They don't develop flowers and seeds, and instead produce structures called capsules that develop spores which grow into new plants. They are mostly more visible after heavy rainfall in areas that remain moist for several weeks, including creek lines and banks, heavily shaded areas, and flats or gentle slopes with water seepage. At least 28 liverwort species have been recorded on Black Mountain; five of them were first located there in 2020 after searches during prolonged wet conditions.

Liverworts are generally divided into two types: leafy and thallose.

Leafy liverworts have stems with leaves arranged in two or three rows and can be easily confused with mosses.

A leafy liverwort with two rows of tiny leaves visible along each stem;
each leaf is less than 1 mm long

Thallose liverworts have a structure called a thallus that lies flat on the ground; in most species the thallus is thick and fleshy, but in some species it resembles miniature lettuce plants.

A flat thallus with branches 6–7 mm long

A lettuce-like thallus in clumps 2–3 mm across

Flat thallus liverworts (F) growing among lettuce-like thallus liverworts (L)

Most thallose liverworts on Black Mountain grow on bare soil and become anchored to the ground by root-like structures on the bottom surface. They help prevent soil erosion during wet conditions and also play an important role in nutrient recycling by trapping nutrients dissolved in the rain and returning nutrients to the soil when the thallus decays.

More detailed information about liverworts and similar plants called hornworts can be found on the web site of the Australian National Botanic Gardens (see www.anbg.gov.au/bryophyte/what-is-liverwort.html).

Where can I find liverworts on Black Mountain?

Thallose liverworts are the easiest ones to find on Black Mountain. The twelve species most likely to be seen there are described on the following pages. The best places to look for them are on the creek flats and adjacent gentle slopes along the Powerline Track in the north of the reserve, and in the open grassy and shrubby areas along the Lower Woodland Track in the south west. Because they are so small, you need to 'get up close' to find them – try squatting or kneeling on the ground. While the plants can be seen with the naked eye, a x2 or x3 magnifying glass can be a useful aid. Be careful not to trample on other plants when looking for them, and don't damage any liverwort plants that you find.

How do I recognise the different thallose liverwort species?

The following key will help you to identify the twelve thallose species. The features described in the key are best observed using a x10 hand lens, or by taking a close-up photo and looking at it on your camera screen or on a computer screen.

To use the key, start from number 1 in the left column, and for each pair of numbers, called couplets (1a and 1b, 2a and 2b etc), decide which description best fits the plant you are looking at. The right column will either indicate the scientific name of the species (they don't have common names) or show the next couplet to look at. All the species are illustrated in the relevant sections.

Key to thallose liverwort species

1a. Thallus branches with closely packed, crinkled leaf-like wings (and look like jumbled, miniature lettuce plants)	***Fossombronia pusilla*** (see Section A)
1b. Thallus branches not lettuce-like	Go to couplet 2
2a. Thallus branches broad (to 10 mm wide), with rounded ends and crescent-shaped 'cups' on the top surface	***Lunularia cruciata*** (see Section B)
2b. Thallus branches strap-like; crescent-shaped 'cups' absent	Go to couplet 3
3a. Thallus branches elongated, flattish sheets more than 3 mm wide, with black edges and tiny white dots on the top surface	Go to couplet 4
3b. Thallus branches broadly triangular or Y- or V-shaped when viewed from above, less than 3 mm wide if with black edges	Go to couplet 5
4a. Green, branched, umbrella-shaped structures 3–5 mm in diameter present on the top surface of the thallus branches	***Asterella drummondii*** (see Section C)
4b. Shiny black, bi-convex sacs present underneath the tips of the thallus branches	***Targionia lorbeeriana*** (see Section C)
5a. Thallus branches large (> 5 mm long, > 3 mm wide)	Go to couplet 6
5b. Thallus branches small/tiny (< 5 mm long, < 3 mm wide)	Go to couplet 7
6a. Top surface of thallus branches shiny and smooth	***Riccia cartilaginosa*** *or* ***Riccia papulosa*** (see Section D)
6b. Top surface of thallus branches not shiny and appears to be covered with minute crystals or ground glass	***Riccia crystallina*** (see Section D)
7a. Thallus branches with hairy or black edges	Go to couplet 8
7a. Thallus branches without hairy or black edges	Go to couplet 9
8a. Thallus branches with hairy edges	***Riccia crinita*** (see Section E)
8b. Thallus branches with black edges	***Riccia nigrella*** (see Section E)
9a. Thallus branches thread-like, < 1 mm wide	***Riccia duplex*** (see Section E)
9b. Thallus branches not thread-like, usually >1 mm wide	Go to couplet 10
10a. Thallus branches pointed at the tips and with a deep groove along the centre of the top surface	***Riccia sorocarpa*** (see Section E)
10b. Thallus branches rounded to squarish at the tips and with a shallow groove along the centre of the top surface	***Riccia subbifurca*** (see Section E)

Descriptions and photos of species

Section A. *Fossombronia pusilla*

The bright green thallus looks like miniature lettuce plants and often forms dense mats. Tiny black globules (capsules) first appear among the leaf-like wings of the thallus and are then raised on slender white stalks. *Fossombronia* grows on the soil surface, in wet areas such as creek flats or drainage lines.

Section B. *Lunularia cruciata*

The thallus branches are around 10 mm wide, rounded at the ends and have small crescent-shaped 'cups' on the top surface. The 'cups' contain tiny disc-like structures called gemmae each of which can develop into a new plant. *Lunularia* grows on soil and rock surfaces in shady sites, often in dry sclerophyll forest.

Section C. *Asterella drummondii* and *Targionia lorbeeriana*

These two species have elongated, strap-like thallus branches up to 10 mm long and usually more than 3 mm wide, with black edges, and tiny white dots on the top surface. They can be difficult to tell apart if they have not yet developed their reproductive organs.

C1. *Asterella drummondii*

Asterella plants are distinguished by their umbrella-shaped reproductive organs growing from the top surface of the thallus branches. Each 'umbrella' (called a carpocephalum) is 3–5 mm in diameter and produces several whitish, elongated structures made of scales that hang below it and contain darkly pigmented capsules. When crushed, *Asterella* gives off a fishy odour. It grows on the soil surface on creek banks, drainage flats and gentle slopes in grassland areas.

Three carpocephala with their whitish scales visible below

A dense cluster of plants with a 'mini-forest' of carpocephala.

The tiny green globules on these young *Asterella* plants are immature carpocephala. The purplish rough 'pads' towards the tips of the two thallus branches on the bottom left are the male sex organs (called gametangia).

C2. *Targionia lorbeeriana*

Targionia plants are distinguished by growing a black, bi-convex capsule about 3 mm long on the bottom surface of the thallus lobes. They grow on soil or rock surfaces, mostly on shaded creek banks, and often form dense mats.

Section D. *Riccia* species with a large thallus: *Riccia crystallina*, *Riccia cartilaginosa* and *Riccia papulosa*

The thallus branches of these three species are usually > 5 mm long, and > 3 mm wide. When viewed from above, the thallus branches are broadly triangular or Y- or V-shaped, and form rosettes or dense mats.

D1. *Riccia crystallina*

Riccia crystallina has broadly triangular thallus branches that often form rosettes. The top surface of the thallus looks as though it's covered in tiny crystals or ground glass. The plants grow on mud in wet areas.

D2. *Riccia cartilaginosa*

Riccia cartilaginosa has broadly triangular or broadly Y-shaped thallus branches that are smooth and often shiny green. They can form rosettes or dense mats, and grow on the soil surface in grassland and grassy woodland.

D3. *Riccia papulosa*

Riccia papulosa usually has broadly Y-shaped thallus branches that are pale or bright green, smooth and not as shiny as *Riccia cartilaginosa*. It can be distinguished by a honeycomb pattern of tiny holes on the older section of the branches; the holes lead to air cavities that are within the thallus of the plant. The plants form rosettes or dense mats, and grow on the soil surface in grassland and grassy woodland.

Section E. *Riccia* species with a small or tiny thallus: *Riccia crinita*, *Riccia duplex*, *Riccia nigrella*, *Riccia sorocarpa* and *Riccia subbifurca*

The thallus branches of these species are usually < 5 mm long, and < 3 mm wide. When viewed from above, the thallus branches are usually Y- or V-shaped, and form rosettes or dense mats.

E1. *Riccia crinita*

Riccia crinitia is distinguished by the hairy edges of its thallus branches. It grows on the soil surface in grassland and grassy woodland.

E2. *Riccia duplex*

Riccia duplex is distinguished by its thread-like thallus branches < 1 mm wide. It grows on wet mud in drainage lines.

E3. *Riccia nigrella*

Riccia nigrella is distinguished by the black edges of its thallus branches and the rusty colouring at their base. It grows on the soil surface in grassland and grassy woodland.

E4. *Riccia sorocarpa*

Riccia sorocarpa is distinguished by its green edged, hairless thallus, the deep groove running along the length of the branches and their pointed tips. It grows on the soil surface in grassland and grassy woodland.

E5. *Riccia subbifurca*

Riccia subbifurca is distinguished by its green edged, hairless thallus; thallus branches that have a broad shallow groove running along their length with a swollen margin on either side; and the rounded or squarish shaped tips of the branches. It grows on the soil surface in grassland and grassy woodland.

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